Automata:

Robotics has advanced in ways that we had never imagined. This attitude of innovation is what inspires ‘AUTOMATA’, the flagship event of ENGINEER. AUTOMATA is back, to taunt you with a challenging problem statement. Get ready to be surprised this year with a twist that you would never have thought of.   
The ultimate image processing event. Build an autonomous robot and guide it, with only the help of images acquired from an overhead camera, from the start position on an arena to the end position following a specific path. The ‘Specified Path’ is your problem, code is your solution.   
Number of members in a team: max 4

Problem Statement

**Arena Details**

* The arena will be a non-reflective surface on top of a wooden base.
* An overhead camera is positioned on top of the arena so that it is completely visible. The position of the camera with respect to the arena will be fixed.
* The arena consists of a white background with square nodes at certain points. One of the nodes is the finish node, and will be marked in RED, while the rest of the nodes will be BLACK.
* The nodes are inter-connected by BLACK “paths”(there may not be a direct connection between every given pair of nodes).

**Objectives**

* The robot has to traverse through the arena, to reach the RED node, from a specified node, using the shortest path available.
* Reaching the final node, without traversing the shortest path, may be considered for evaluation only no robot ever moves ahead on the shortest available path.
* The only input to you will be the stream from the overhead camera feed.
* The robot can move ahead only on the paths connecting the nodes.
* ONLY DC MOTORS are allowed. Steppers and wheel encoders will lead to disqualification of the team.
* There will be a maximum of 15 minutes for each team in which they can have as many trials as required. Teams will also be given 10 minutes for calibration.
* All teams must submit their bots, codes, or laptops at the start of the competition.

## Scoring Criteria

* The best time is taken in consideration.
* Any deviation from path will lead to restart of trial.
* In case of no one completing the traversal of arena, the team who has gone the farthest will win.
* The scoring is time-based and the team which finishes first wins.
* Illegal robot movements will result in a restart of the trial (Example: Deviation from the paths).
* The trial starts when the robot starts moving from the initial position as mentioned in the figure.
* The trial ends when the robot reaches the destination or if the stipulated time ends.
* The team will be penalized every time the robot deviates from the path.

## Robot Details

* The robot should be completely autonomous.
* The robot should fit into a box of dimensions 20x18 (length x width).
* The robot is required to have an onboard power source not based on combustion.
* The maximum voltage between any two points on the robot should not exceed 12 volts.
* The robots are NOT allowed to have stepper motors, sensors for a wheel encoder and any other sensors.
* The robots can communicate with a computer outside the arena either through wired or wireless connection.
* In case of a wired connection, the wire must be kept slack all the time and must emerge from the top of the robot.
* Use of on-board camera is not allowed.
* The following software for image processing are allowed:
* Open CV
* MATLAB
* Scilab / GNU Octave
* If any other software is used for image processing, please inform us.
* Softwares with ready-made image processing codes/GUIs is not allowed.
* Sharp objects on the robot which may damage the arena will lead to disqualification of the team.

**Camera Details**

* An overhead USB camera is placed such that the entire arena is just visible.
* The camera provided by us will support image acquisition in these modes: 640x480, 1600x1200 and in RGB/YUV formats.
* The teams will have to use the camera provided by us.

## General Information

* A maximum of 4 members per team is allowed. We do not provide computers to the participating teams. It is expected that you arrange for your own.
* The robot will initially be placed in a node of our choice. The starting node may be different for different teams.